

# THE ROYAL EXAM SERIES

Kenya Certificate of Secondary Education

121/1 — MATHEMATICS — Paper 1

FORM 4

TERM 2

DECEMBER 2021- 2 1/2 HOURS



Name..... Index Number:.....

School.....

Candidate's Signature..... Date.....

### INSTRUCTION TO CANDIDATE'S:

1. Write your **name**, **index number** and **school** in the spaces provided above.
2. Write the **date** of examination in spaces provided.
3. This paper consists of **two** Sections; Section **I** and Section **II**.
4. Answer **ALL** the questions in Section **I** and any **five** questions from Section **II**.
5. All answers and working must be written on the question paper in the spaces provided below each question.
6. Show all the steps in your calculation, giving your answer at each stage in the spaces provided **below** each question.
7. Marks may be given for correct working even if the answer is wrong.
8. Non-programmable silent electronic calculators and KNEC Mathematical tables **may be** used, except where stated otherwise.
9. Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.
10. **Candidates should answer the questions in English.**

### FOR EXAMINER'S USE ONLY:

#### SECTION I

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	TOTAL

#### SECTION II

17	18	19	20	21	22	23	24	TOTAL

**GRAND  
TOTAL**

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**ANSWER ALL THE QUESTIONS IN THIS SECTION.**

1. Evaluate without using mathematical tables

$$\frac{1.9 \times 0.032}{20 \times 0.0038}$$

(3mks)

2. Use tables of reciprocals only to find the value of

$$\frac{5}{0.0829} - \frac{14}{0.581}$$

(3mks)

3. You are given that  $\cos \theta = \frac{8}{10}$ . Without using mathematical tables express in fraction form the value of

(a)  $\sin \theta$

(2mks)

(b)  $\tan (90 - \theta)$

(1mks)

4. An open right circular cone has radius of 5cm and a perpendicular height of 12cm . Calculate the surface area of the cone correct to 1 decimal place.(Take  $\pi$  to be 3.142)

(3mks)

5..Nyongesa spends a total of sh.970 on buying three text books and five pens. If he had bought two text books and five pens he would have saved sh.90. Find the cost of one text book. (3mks)

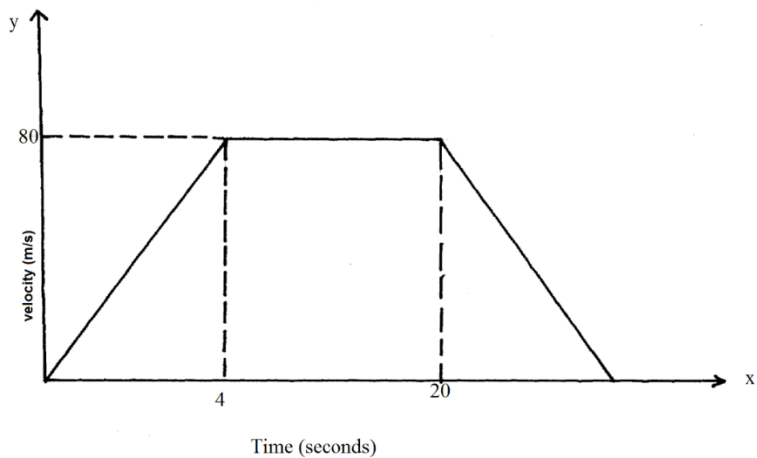
6.A Kenyan tourist left Germany for Kenya through Switzerland. While in Switzerland he bought a watch worth 52 Deutsche marts. 1 swiss Franc = 1.28 DM and 1 Swiss Franc = 45.21 Kenya shillings.

Find the value of the watch in;

(a) Swiss Franc (2mks)

(b) Kenya shillings using the exchange rates above. (2mks)

7. The figure below is a velocity –time graph for a car that was in motion for 24 seconds.



(a) Find the total distance traveled by the car? (2mks)

(b) Calculate the deceleration of the car. (2mks)

8. Form the quadratic equation whose roots are  $x = -\frac{5}{3}$  and  $x = 1$  in the form  $ax^2 + bx + c = 0$ .  
(2mks)

9. Three towns are situated in such a way that town B is 40km due south of town A and town C is 30 km due East of town B.

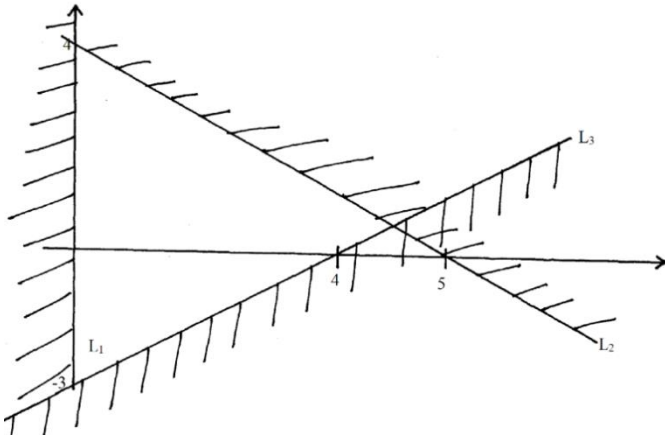
(a) Draw a sketch diagram showing the position of town A, B and C. (1mk)

(b) From your sketch, calculate:

(i) Distance AC (1mk)

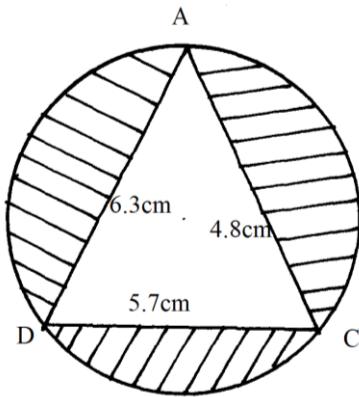
(ii) To the nearest degree the bearing of town A from town C. (2mks)

10. Find the inequalities that defines the region R shown in the figure below (3mks)



11. The interior angle of a regular polygon is  $20^\circ$  more than three times the exterior angle. Determine the number of sides of the polygon. (3 marks)

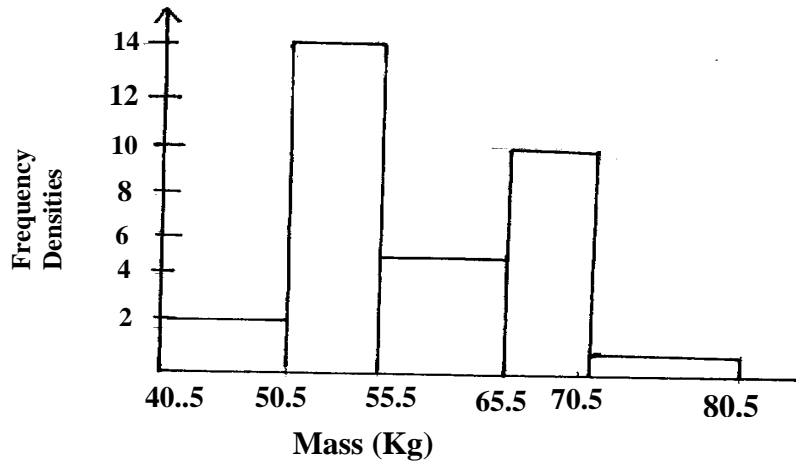
12. The circle below whose area is  $18.05\text{cm}^2$  circumscribes a triangle ABC where  $AB=6.3\text{cm}$ ,  $BC=5.7\text{cm}$  and  $AC=4.8\text{cm}$ . Find the area of the shaded part. (3mks)



13. Solve for  $x$  in the equation  
 $9^{(x-1)} \times 3^{(2x+1)} = 243$

(3mks)

14. The graph below shows frequency densities for the masses of some 200 students selected from a class. Use it to answer the questions that follow:



(a) Complete the frequency distribution table below (2mks)

(b)

Mass in (Kg)					
Frequency					

State the modal frequency (1mk)

15. The volumes of two similar solid cylinders are  $4752 \text{ cm}^3$  and  $1408 \text{ cm}^3$ . If the area of the curved surface of the smaller cylinder is  $352 \text{ cm}^2$ , find the area of the curved surface of the larger cylinder (3mks)

16. The line which joins the point A (3, K) and B (-2, 5) is parallel to the line whose equation is  $5y + 2x - 7 = 0$ . Find the value of K. (3mks)

**SECTION II (50 MARKS)**

*Answer only five questions in this section in the spaces provided.*

17. John bought 3 brands of tea, A B and C. The cost price of the three brands were sh 25, sh 30, sh 45 per kg respectively. He mixed the three brands in the ratio 5:2:1 respectively: After selling the mixture he made a profit of 20%.

(a) How much profit did he make per kilogram of the mixture? (4 mks)

(b) After one year the cost price of each brand was increased by 10%

i) For how much did he sell one kilogram of the mixture to make a profit of 15%? (Give your answer to the nearest 5 cents) (3 mks)

(ii) What would have been his percentage profit if he sold one kilogram of the mixture at sh. 45. (3 mks)

18. The equation of a curve is given as  $y=2x^3-\frac{9}{2}x^2-15x+3$

(a) Find:

(i) the value of  $y$  when  $x=2$

(2 marks)

(ii) the equation of the tangent to the curve at  $x=2$

(4 marks)

(b) determine the turning points of the curve

(4 marks)



19. (a) Using the trapezium rule with 7 ordinates, estimate the area of the region bounded by the curve  $y = -x^2 + 6x + 1$ , the lines  $x=0$ ,  $y=0$  and  $x=6$ . (5mks)

b) Calculate :

i) The area of the region in (a) above by the integration;

(3mks)

ii) The percentage error of the estimated area to the actual area of the region, correct to 2 decimal places.

(2mks)

20. A country bus left town A at 11.45 am and traveled towards town B at an average speed of 60 km/h. A matatu left town B at 1.15 pm on the same day and traveled towards town A along the same road at an average speed of 90 km/h. The distance between the two towns is 540 km. Determine  
(a) The time of day when the two vehicles met (4 mks)

(b) How far from town A did they meet ? (2 mks)

(c) How far outside town B the bus was when the matatu reached town A (4 mks)

21. A straight line passing through the points (8,-2) and (4,-4) has its equation in the form  $ax + by + c = 0$ , where a, b and c are integers.

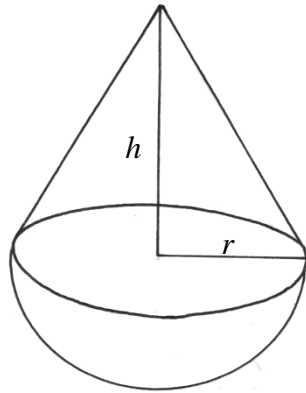
a) **Determine** the numerical values of a, b and c. (3mks)

b) If the line in (a) above cuts the x-axis at point P, **determine** the coordinates of P. (2mks)

c) Another line, which is perpendicular to the line in (a) above passes through point P and cuts the y axis at Q. **determine** the coordinates of point Q. (3mks)

d) **Find** the length of QP (2mks)

22. (a) The figure below shows a metal solid consisting of a right cone mounted onto a hemisphere. The height  $h$  of the cone is twice the radius  $r$ . If the volume of the solid is  $36\text{cm}^3$ , find the radius of the hemisphere. (4mks)

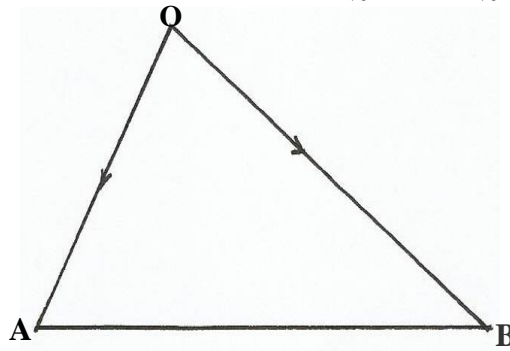


(b) The solid is totally immersed in water contained in a cylindrical tin of radius 9cm. Through what height does the water level in the tin rise? (2mks)

(c) The solid is melted and recast into a right pyramid of vertical height 4.2cm. Find the base area of the pyramid. (2mks)

(d) If the solid is of mass 14.4g. Find its density in  $\text{kg/m}^3$ . (2mks)

23. In the diagram below,  $\triangle AOB$  is a triangle such that  $\vec{OA} = \vec{a}$ ,  $\vec{OB} = \vec{b}$  and  $\angle AOB$  is obtuse.



If  $P$  is a point on  $AB$  such that  $\vec{AP} = 3\vec{PB}$  and  $Q$  is the mid-point of  $OA$

(a) Express in terms of  $\vec{a}$  and  $\vec{b}$

(i)  $\vec{AB}$  (1mk)

(ii)  $\vec{BQ}$  (2mks)

(b) If  $X$  is a point on  $BQ$  such that  $\vec{BX} = h\vec{BQ}$ , express  $\vec{OX}$  in terms of  $\vec{a}$ ,  $\vec{b}$  and  $h$ , where  $h$  is a scalar. (3mks)

(c) Given further that  $\vec{OX} = k\vec{OP}$  where  $k$  is another scalar, obtain the values of  $h$  and  $k$ . (4mks)

24. The table below shows the length of 40 seedlings.

Length in (mm)	Frequency
118-126	3
127 – 135	4
136 – 144	10
145 – 153	12
154 – 162	5
163 – 171	4
172-180	2

Determine

(a) (i) The modal class

(1 Mark)

(ii) The median class

(2 mks)

(b) (i) The mean of the seedlings

(4 mks)

(ii) The median of the seedlings

(3 mks)